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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,558	07/08/2003	Venkatesh Gopinath	01-558	9023
24319	7590	03/09/2005	EXAMINER SMITH, BRADLEY	
LSI LOGIC CORPORATION 1621 BARBER LANE MS: D-106 MILPITAS, CA 95035			ART UNIT 2829	PAPER NUMBER

DATE MAILED: 03/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/615,558

Applicant(s)

GOPINATH ET AL.

Examiner

Bradley K. Smith

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: search notes.

## **DETAILED ACTION**

### ***Specification***

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Selective Hardmask removal.

### ***Claim Rejections - 35 USC § 112***

2. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The examiner does not understand how "the patterned layer" could function as a hard mask and a gate electrode especially when the specification only defines the using dielectric materials for the hardmask.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-10, 13, and 16-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Muller (US Patent 6,207,517). Muller disclose modifying the hard mask layer so that the hard mask layer is etched by the etchant at a substantially faster rate than that at which the etchant etches the underlying layer, patterning the hard mask layer, etching the patterned layer to expose portions of the underlying layer, and etching

both the hard mask layer and the exposed portions of the underlying layer with the etchant, where the etchant etches the hard mask layer at a substantially faster rate than that at which the etchant etches the underlying layer, because of the modification of the hard mask layer (see column 2). With regards to claims 2 and 3, Muller disclose positive and negative patterning. With regards to claim 4, Muller disclose the step of modifying the hard mask layer is accomplished subsequent to the step of etching the patterned layer and prior to the step of etching both the hard mask layer and the exposed portions of the underlying layer. With regards to claim 5, Muller disclose wherein the step of patterning the hard mask layer comprises applying and patterning a photoresist layer and etching the hard mask layer. With regards to claim 6, Muller disclose damaging the crystal structure (see column 2). With regards to claim 7, Muller disclose damaging the crystal structure with ion implantation (see column 2 lines 35-45). With regards to claim 8, Muller disclose damaging the crystal structure with ion implantation with argon (see column 2 lines 35-45). With regards to claim 9, Muller disclose the hard mask and the underlying layer is silicon dioxide (see column 2 lines 5-10). With regards to claim 10, Muller disclose silicon oxide formed with a low temperature oxidation process and a thermal oxidation process (see column 2 lines 5-15). With regards to claim 13, Muller disclose the formation of a transistor (see column 3 lines 50-65). With regards to claims 16 and 19, forming the hard mask layer over the patterned layer, modifying the hard mask layer so that the hard mask layer is etched by the etchant at a substantially faster rate than that at which the etchant etches the underlying layer, patterning the hard mask layer, etching the patterned layer to expose portions of the underlying layer, and etching

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both the hard mask layer and the exposed portions of the underlying layer with the etchant, where the etchant etches the hard mask layer at a substantially faster rate than that at which the etchant etches the underlying layer, because of the modification of the hard mask layer (see column 2). With regards to claims 17 and 20 , Muller disclose damaging the crystal structure with ion implantation (see column 2 lines 35-45). With regards to claim 17 , Muller disclose the hard mask and the underlying layer are made of silicon oxide.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 12 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Muller (US Patent 6,207,517) in view of Hopper et al. (US Patent 6,285,057).

Muller disclose modifying the hard mask layer so that the hard mask layer is etched by the etchant at a substantially faster rate than that at which the etchant etches the ' underlying layer, patterning the hard mask layer, etching the patterned layer to expose portions of the underlying layer, and etching both the hard mask layer and the exposed portions of the underlying layer with the etchant, where the etchant etches the hard mask layer at a substantially faster rate than that at which the etchant etches the underlying layer, because of the modification of the hard mask layer (see column 2).

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However Muller fails to disclose etching with a solution of hydrofluoric acid and phosphoric acid. Whereas Hopper et al. disclose the etching with a solution of hydrofluoric acid and phosphoric acid (see column 5 lines 40-45). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Muller and Hopper because the use of hydrofluoric acid and phosphoric acid on a hard mask is well known in the art (see Hopper column 5 line 42-43).

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Muller (US Patent 6,207,517) in view of Liu et al. (US Patent 6,326,300). Muller disclose modifying the hard mask layer so that the hard mask layer is etched by the etchant at a substantially faster rate than that at which the etchant etches the underlying layer, patterning the hard mask layer, etching the patterned layer to expose portions of the underlying layer, and etching both the hard mask layer and the exposed portions of the underlying layer with the etchant, where the etchant etches the hard mask layer at a substantially faster rate than that at which the etchant etches the underlying layer, because of the modification of the hard mask layer (see column 2). However Muller fails to disclose the use of silicon oxynitride as a hard mask. Whereas Liu et al. disclose the use of silicon oxy nitride as a hard mask. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Muller and Liu et al, because silicon oxynitride etch rates can be varied.

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Muller (US Patent 6,207,517). Muller disclose modifying the hard mask layer so that the hard

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mask layer is etched by the etchant at a substantially faster rate than that at which the etchant etches the underlying layer, patterning the hard mask layer, etching the patterned layer to expose portions of the underlying layer, and etching both the hard mask layer and the exposed portions of the underlying layer with the etchant, where the etchant etches the hard mask layer at a substantially faster rate than that at which the etchant etches the underlying layer, because of the modification of the hard mask layer (see column 2). Muller discloses the claimed invention except for wherein the hard mask layer has a thickness of from about two hundred angstroms to about five hundred angstroms and the underlying layer has a thickness of about twenty angstroms. It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the hard mask layer has a thickness of from about two hundred angstroms to about five hundred angstroms and the underlying layer has a thickness of about twenty angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233, and because the thinner oxide will enable more device on the chip.

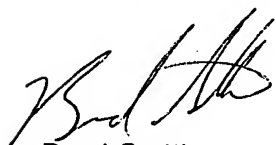
### ***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yu et al. (US Patent 6,573,193) disclose the use of hydrofluoric acid and phosphoric acid.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bradley K. Smith whose telephone number is (571) 272-1884. The examiner can normally be reached on 10-6 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Brad Smith  
Primary Examiner  
Art Unit 2829